

JPSS Support Scientist for OCONUS

**Jordan Gerth**

# Background

- University of Wisconsin BS '09, MS '11, and PhD '13 (Atmospheric and Oceanic Sciences)
- Experience in numerical weather prediction and satellite meteorology
- Helped to pioneer R2O activities at CIMSS in 2006 (first project was MODIS)
- Involved with GOES-R and JPSS Proving Grounds since the beginning

# Summary

- The OCONUS support scientist focuses on:
  - Conducting scientific investigations and serving as the coordinator for demonstrating JPSS-related science products in National Weather Service Pacific Region and Alaska Region operations
  - Integrating GOES-R and JPSS imagery and science products into AWIPS II
  - Acting as a technical coordinator and AWIPS II developer for GOES-R and JPSS proving ground partners
  - Other relevant tasks

# Proposed Tasks

- Task 1: Coordinate, facilitate, and participate in development of satellite program data products and techniques into technical systems (e.g., AWIPS II)
- Task 2: Communicate development status to Pacific Region office staff and headquarters, and GOES-R and JPSS management, staff, and liaisons
  - Lead office and program technical interchange meetings/forum and training where applicable



# Proposed Tasks

- Task 3: Travel to OCONUS for interactions with forecasters and ITOs, and to CONUS locations (e.g., Kansas City, Omaha, Silver Spring) for personal skill development and/or technical interchange with AWIPS II system developers
- Task 4: Develop a portfolio of current JPSS science products that have value to operational meteorology in Pacific Region and Alaska Region, and demonstrate capabilities of those with the most potential

# Proposed Tasks

- Task 5: Facilitate scientific and operational initiatives seeking to optimize the current and future use of satellite data in the Pacific Region and Alaska Region
  - Analyze leading edge research and present initiative results
- Task 6: Engage with Pacific Region and Alaska Region Environmental Scientific and Services Divisions, as well as MICs, SOOs, and DOHs, to determine potential blended and/or decision support products

# Pacific Region VSP

- Visits from product/algorithm developers as part of the Pacific Region Visiting Scientist Program are critical to the success of OCONUS proving ground activities
- A successful VSP is built on:
  - Adequate planning
  - Products and algorithms which add value
  - Focused, one-on-one interactions with willing forecasters so that the VSP participant identifies forecast challenges and understands how the forecaster will use the demonstrated product/algorithm
    - Assuring that the forecaster understands the product and how to adequately apply it in an operational setting
  - A product/algorithm that is consistent and reliable
  - Ensuring that an adequate in-house test period exists before the product/algorithm developer transitions the product/algorithm to a field demonstration, and that the operational software displays it accurately
  - A follow-up visit or subsequent communication following changes to the product/algorithm

# FY14 Accomplishments

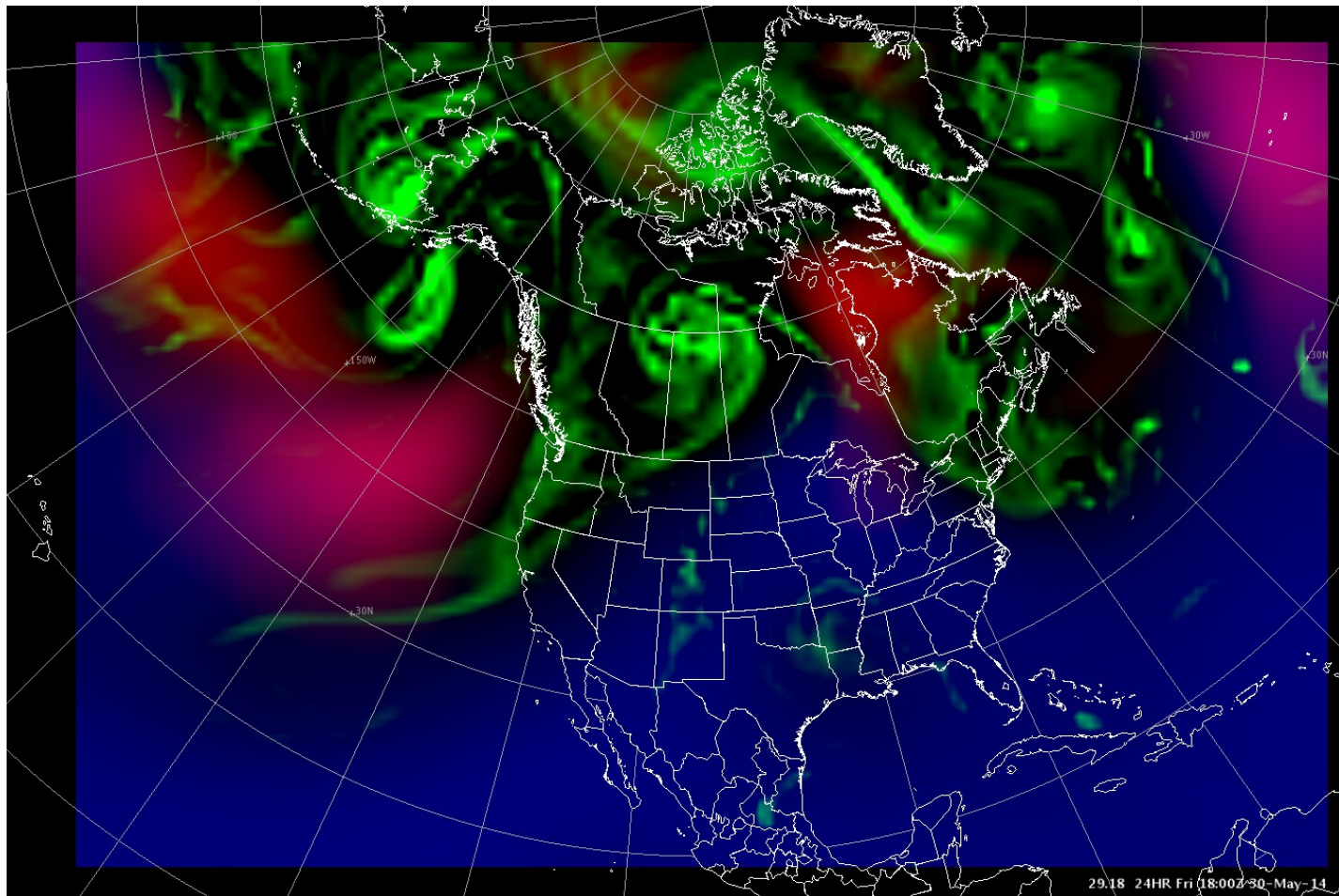
- First VSP participants in May 2014 from SPoRT successfully introduced QPE to forecasters
- AWIPS II enhancements
  - Multi-source RGB imagery (e.g., gridded, satellite)
  - NUCAPS plan view imagery (under development)
- Contributed to ProbSevere plug-in development demonstrated in the 2014 Hazardous Weather Testbed
- Planned 2014 OCONUS satellite proving ground meeting in Honolulu
- Developing one-page fact sheets for each of the ABI bands (one band per month starting this fall)
- Engaged with Tim Schmit and the NOAT on a number of issues related to Mode 3 vs. Mode 4 and CONUS sector position
  - Working on scheduling exploratory scan strategies

# Evolving Roles

- Helping to bridge the R2O gap on the research side
  - Liaison paradigm was originally constructed around directly interfacing with operations
  - Includes facilitating between the NOAT and TAG
- Conducting independent research and leading research team
  - Ongoing sky cover research
    - Interacting with EMC to improve cloud representation in model analyses
  - Potential new proposals
- Conducting collaborative research jointly with NWS Pacific Region, focusing on scientific meteorological questions relevant to the subtropical Central Pacific
  - Frontal passages
- Coordinating L/X-band antenna installations and maintenance with NWS Pacific Region
- Supporting AWIPS activities at CIMSS
- Planning relevant meetings (e.g., NOAA Satellite Science Week)

# AWIPS II Gridded RGB Example

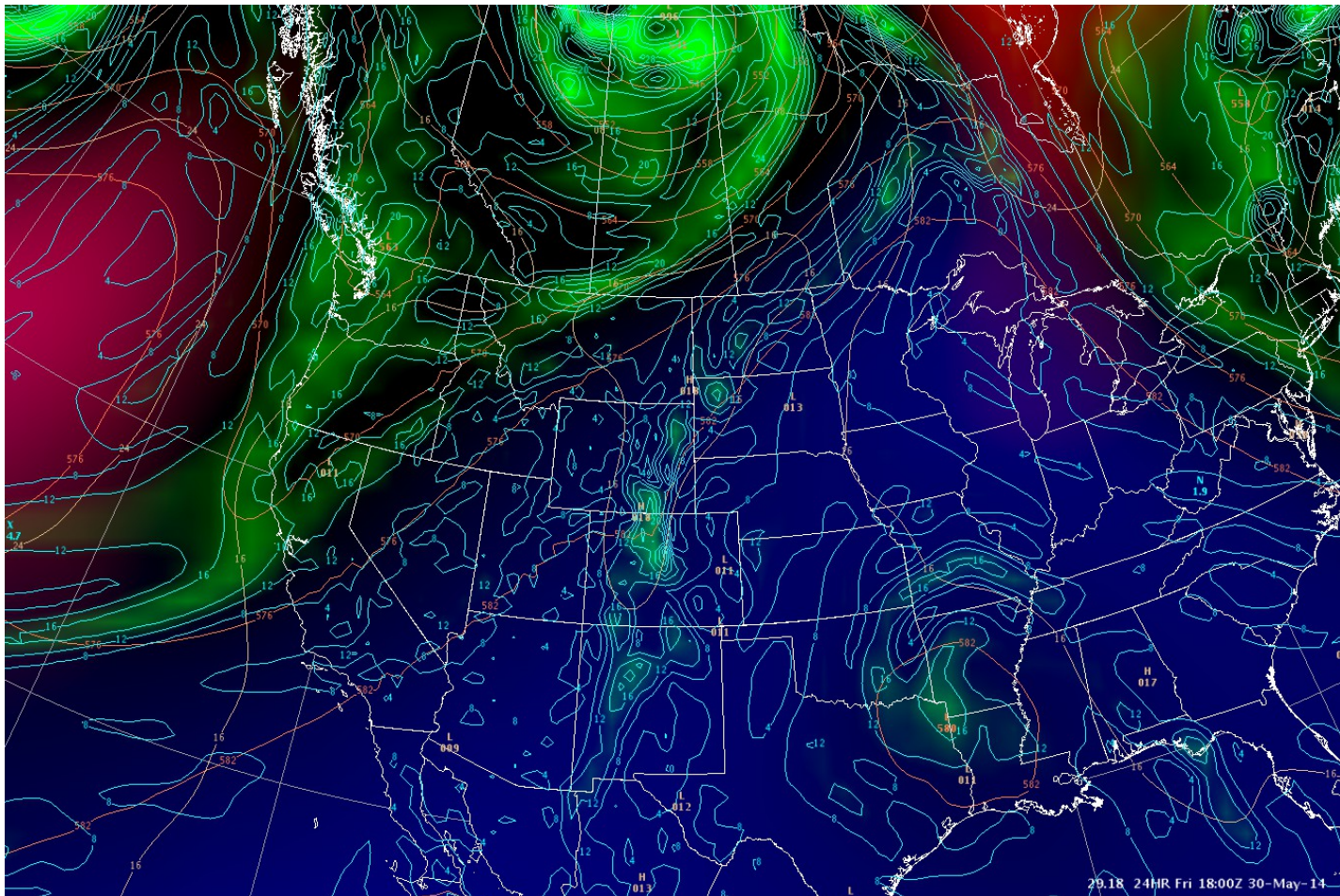
Developed capability for gridded data display as an RGB





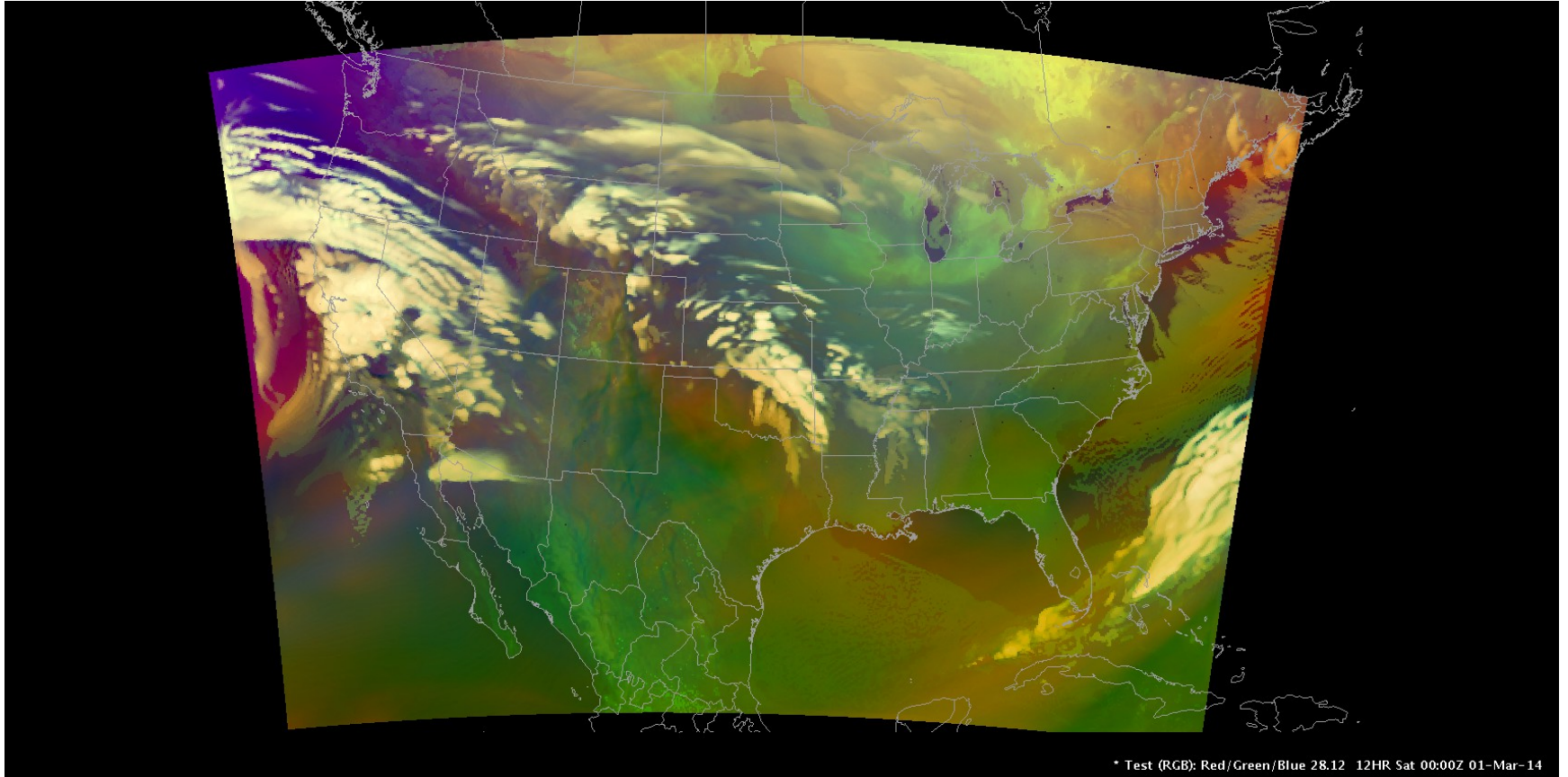
# AWIPS II Gridded RGB Example

Developed capability for gridded data display as an RGB



# AWIPS II Gridded RGB Example

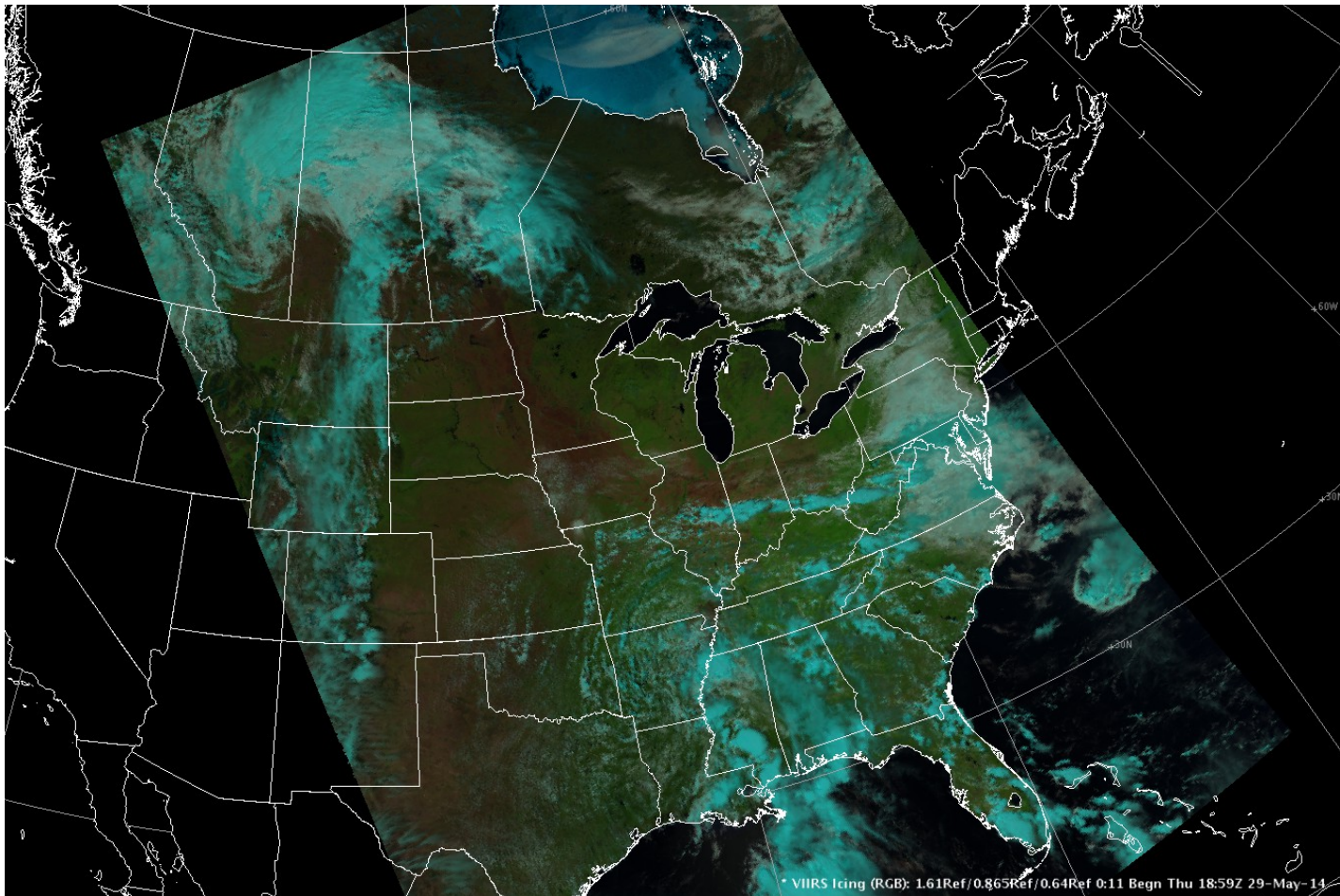
Simulated imagery project with Brad Pierce, Kaba Bah





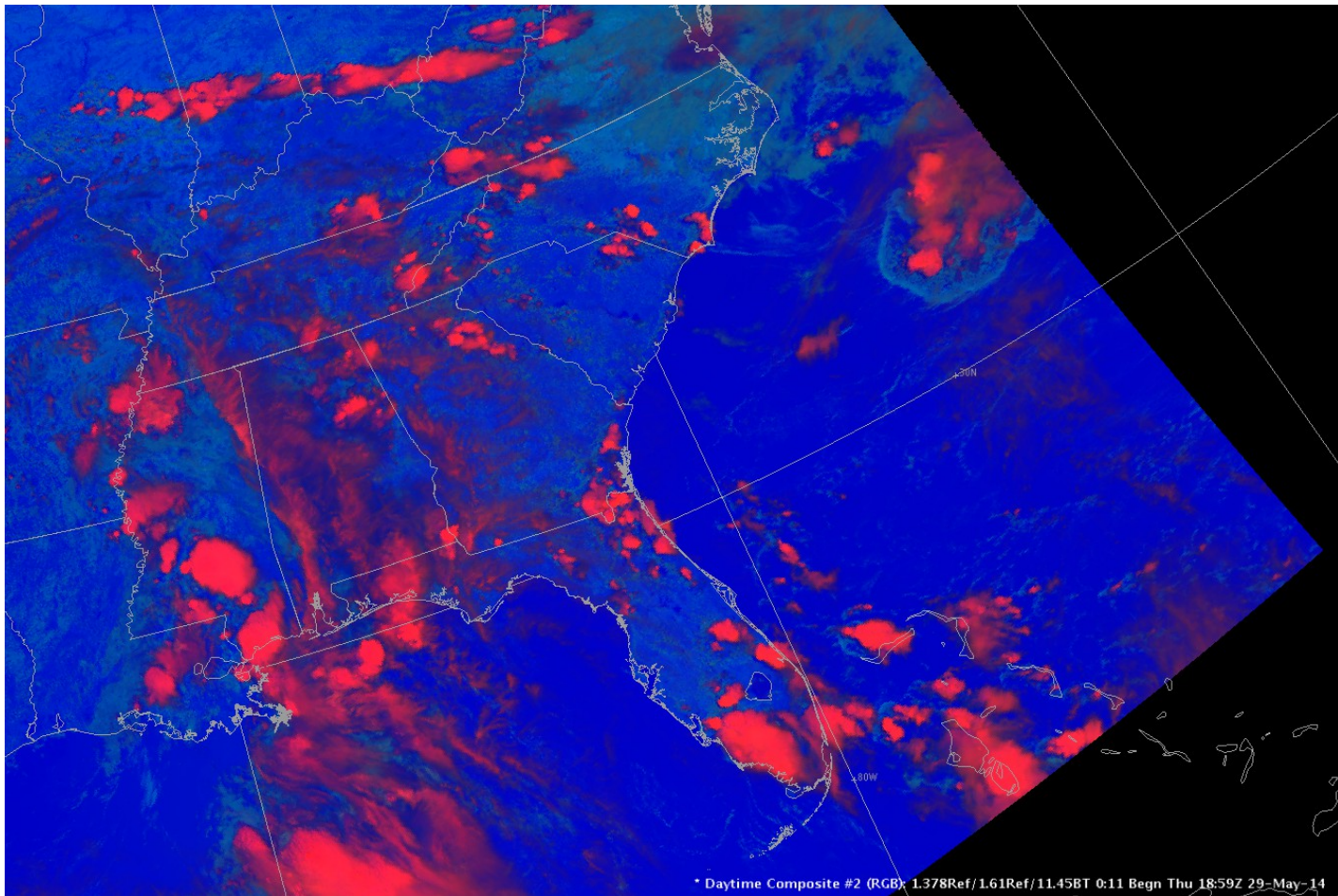
# RGB Example: VIIRS Icing

(1.61  $\mu\text{m}$ , 0.865  $\mu\text{m}$ , 0.64  $\mu\text{m}$ )



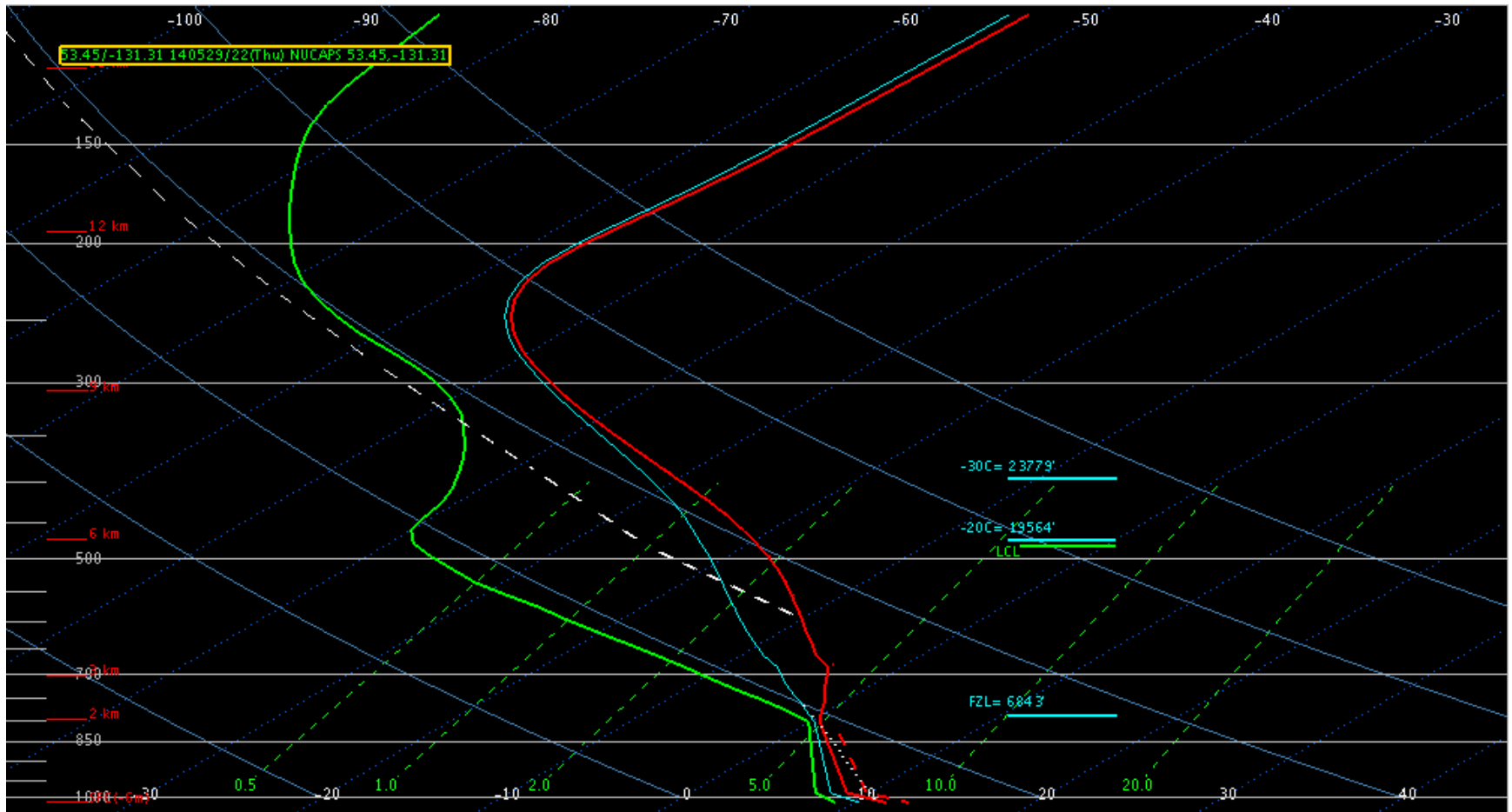
# VIIRS Daytime Composite #2

(1.378  $\mu\text{m}$ , 1.61  $\mu\text{m}$ , 11.45  $\mu\text{m}$ )



# AWIPS II NUCAPS Soundings

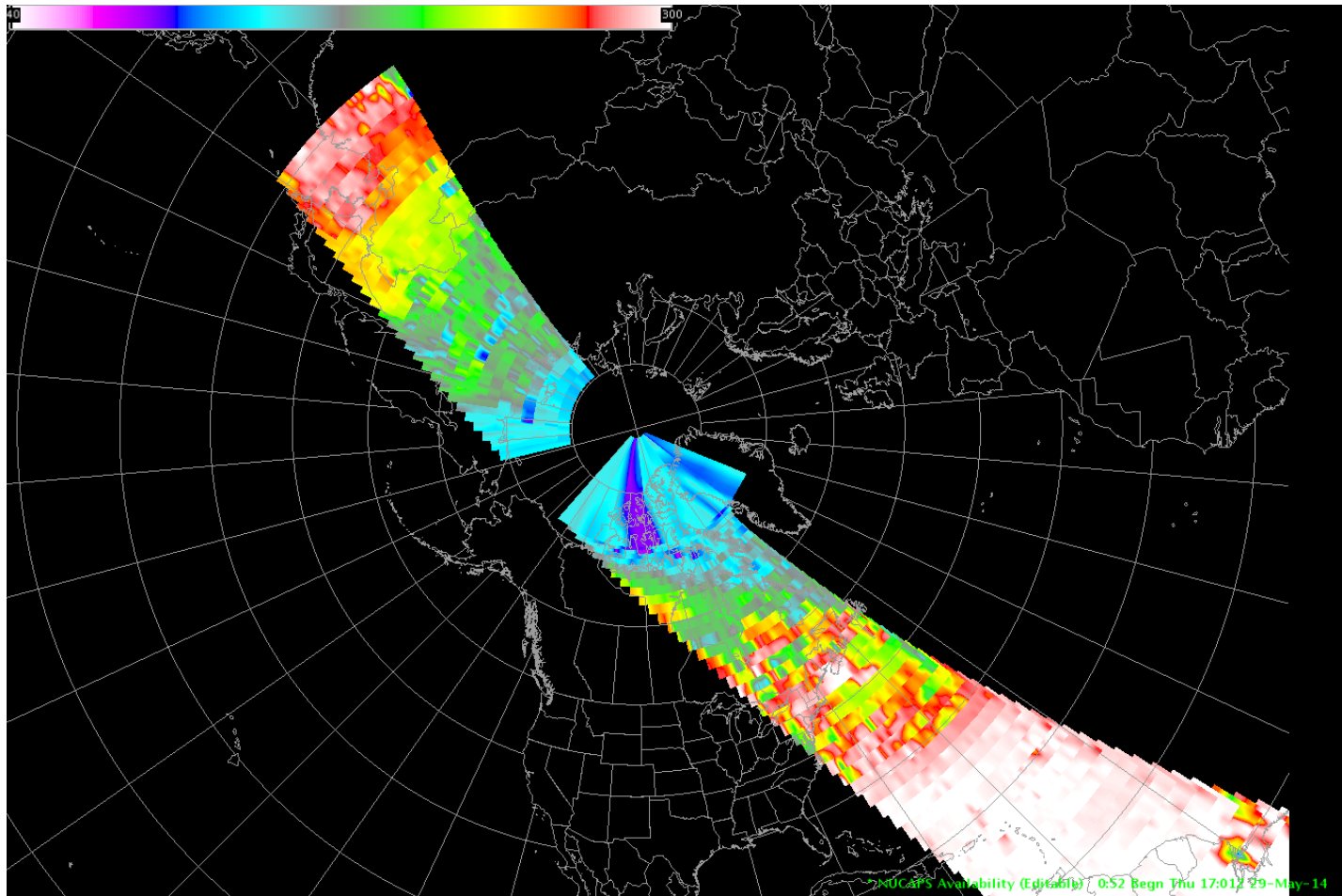
Click to load capability exists for individual points





# AWIPS II NUCAPS Soundings

Plan to render individual soundings into plan view



# Challenges

- Coping with distance between CIMSS and OCONUS
  - Travel considerations
    - Flights between Madison and Honolulu are over 12 hours one way
    - Two days “lost” to travel with every trip
    - Based on current schedule, I will “lose” over two weeks to travel in a year
  - Inability to quickly visit OCONUS
  - Staggered work hours to better interact with NWS Pacific Region
- Overcoming barriers to access AWIPS II training, support, and baseline code releases (including contributing code to the baseline)
- Obtaining and retaining Common Access Card for access to operational AWIPS workstations and supporting remote sites

# Supporting GOES-R

- Scan strategies
  - Expanded “CONUS” sector size
  - Routine Northern Hemisphere
- Dual operations
  - Considerations for GOES-R and GOES-S scan strategies
- GOES-West “CONUS” sector
- Individual band fact sheets
- Assistance to the technical advisory group

There are some alternative ABI scan strategies to Mode 3 and Mode 4.

Option  
**A**

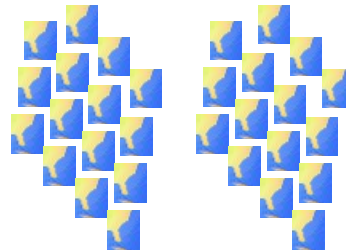


Every **15** minutes &



One **extended**  
"CONUS" sector  
every **5** minutes

&



One mesoscale sector  
every **30** seconds  
(or 1 minute at two locations)

Option  
**B**



Every **3** minutes  
(with 6 min gap)

&

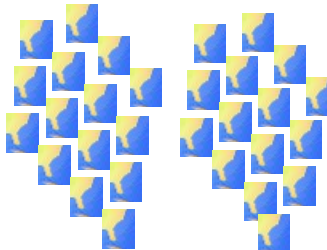


One **wider**  
"CONUS" sector  
in 6 minute gaps

Every **15** minutes

CONUS covered every 3 minutes

&



One mesoscale sector  
every **30** seconds  
(or 1 minute at two locations)

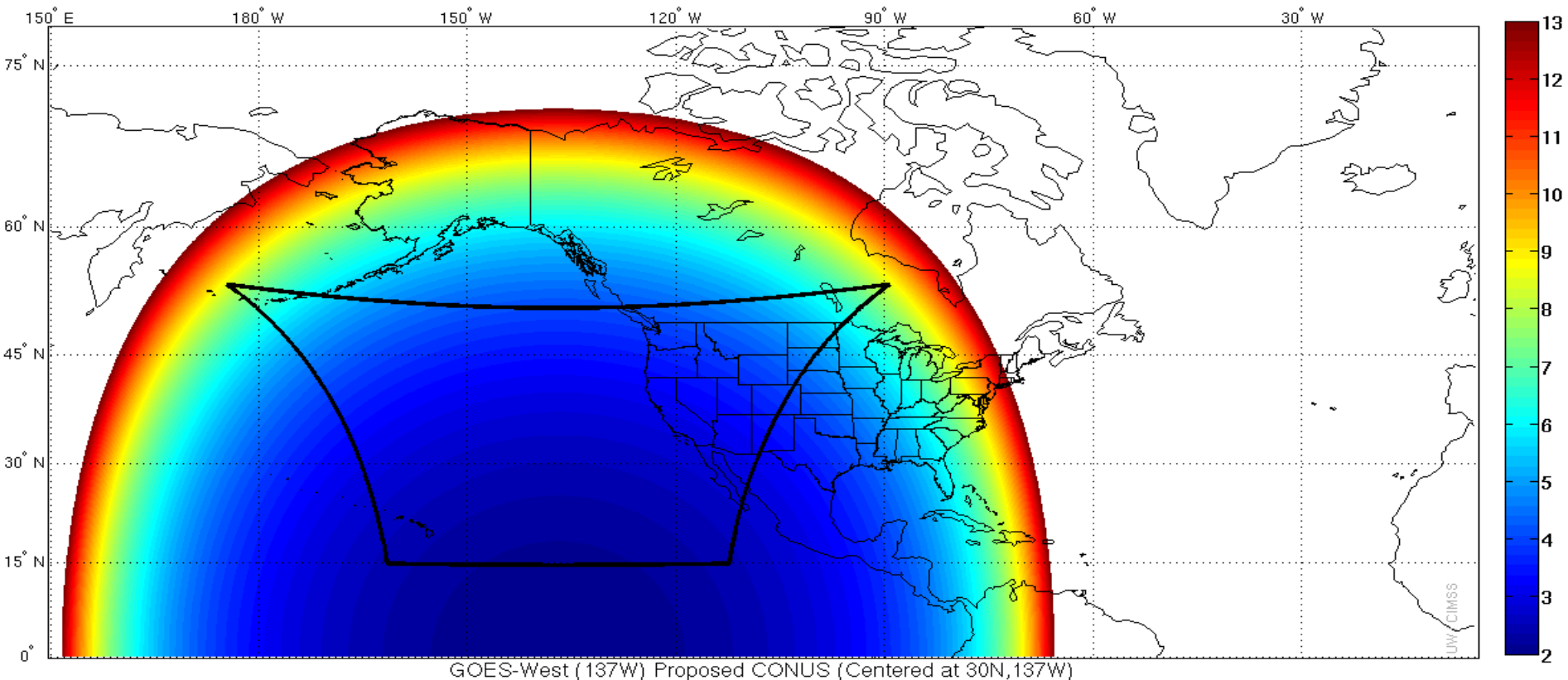


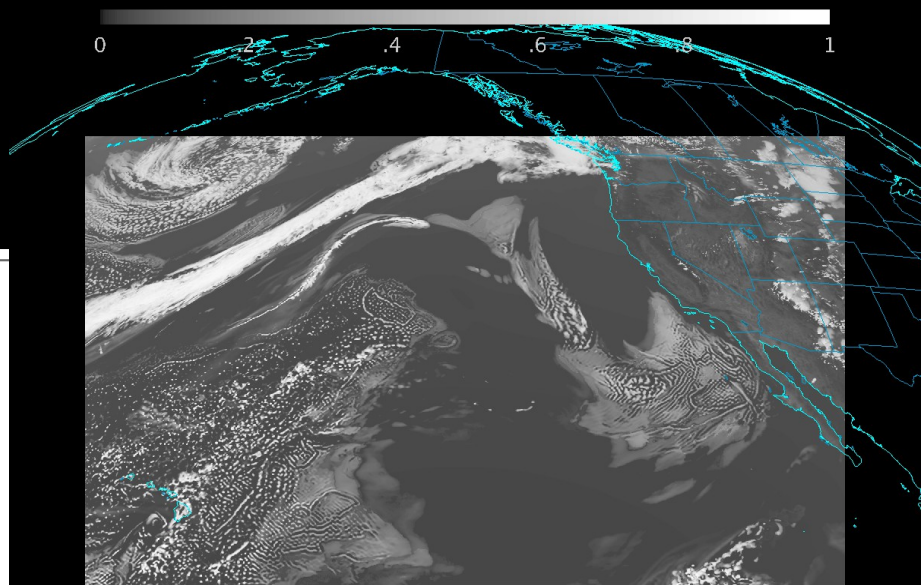
# Shifted CONUS from ABI

- Original plans for GOES-R called for CONUS sectors from both GOES-East and -West to be overlapping views of the continental US.
- These plans changed as it was realized that overlapping views of CONUS from –East and –West are not as advantageous to the mission as spreading the CONUS sectors apart and covering more area. Additionally, this takes advantage of the better viewing angles from East of actual CONUS and the Pacific region from West.
- GORWG approved new CONUS scans that shift the West CONUS sector significantly to the West (centered at 30N, 137W), allowing Hawaii to be scanned.

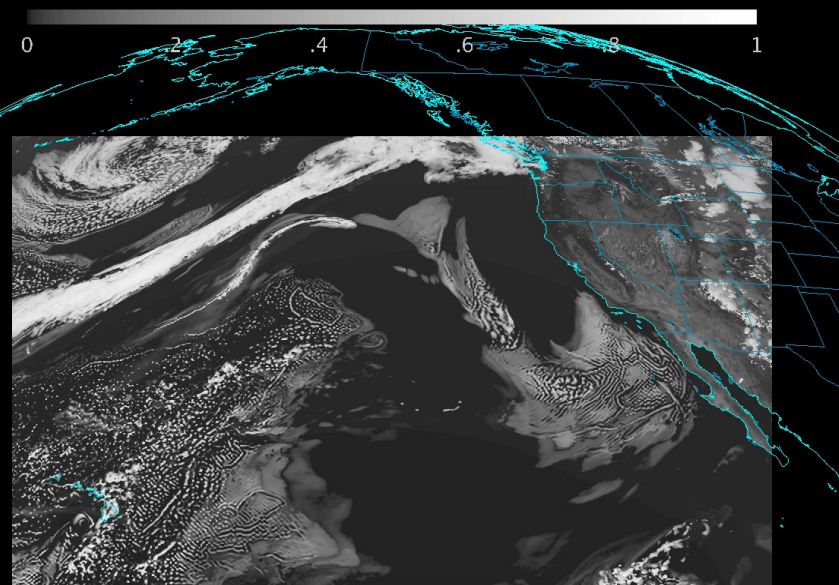


# GORWG-Approved GOES-West (137 W) CONUS Sector (increasing pixel size of observable region)

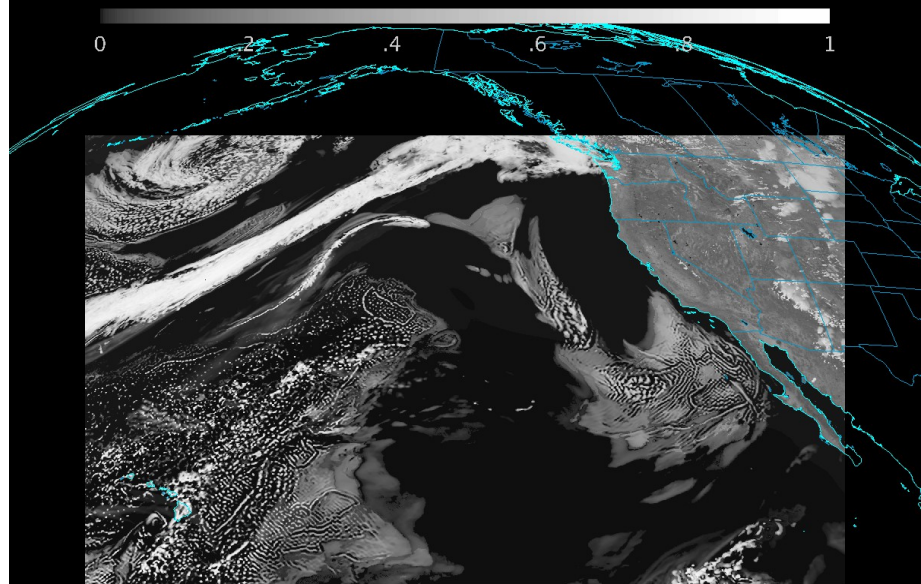




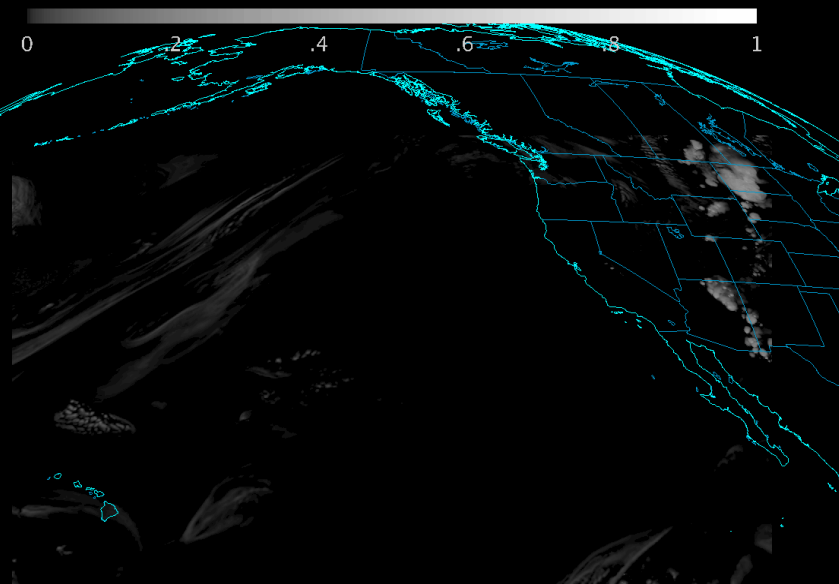
**GOES-R ABI 137W Refl\_b01 2008\_0626\_2200UTC**



**GOES-R ABI 137W Refl\_b02 2008\_0626\_2200UTC**

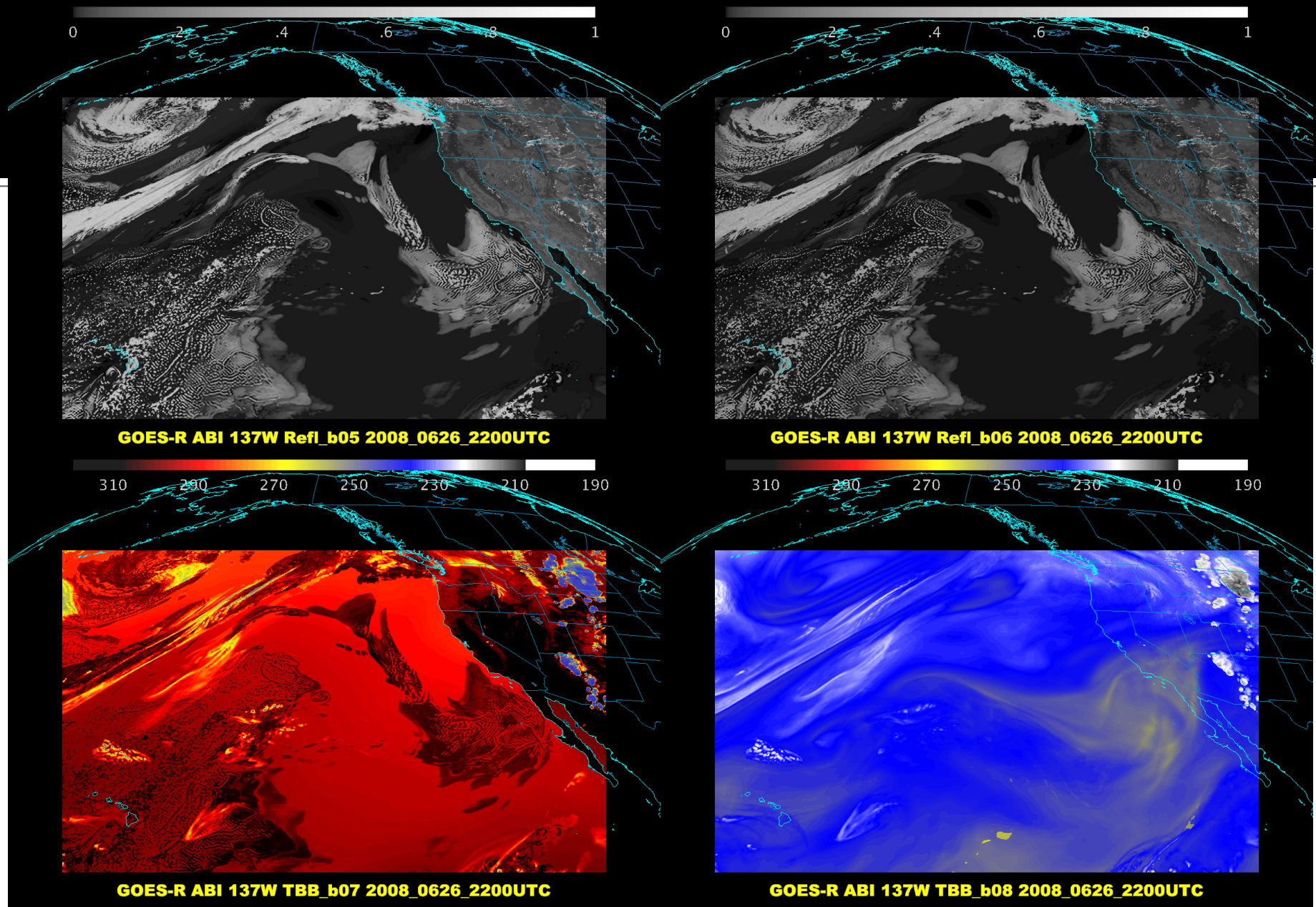


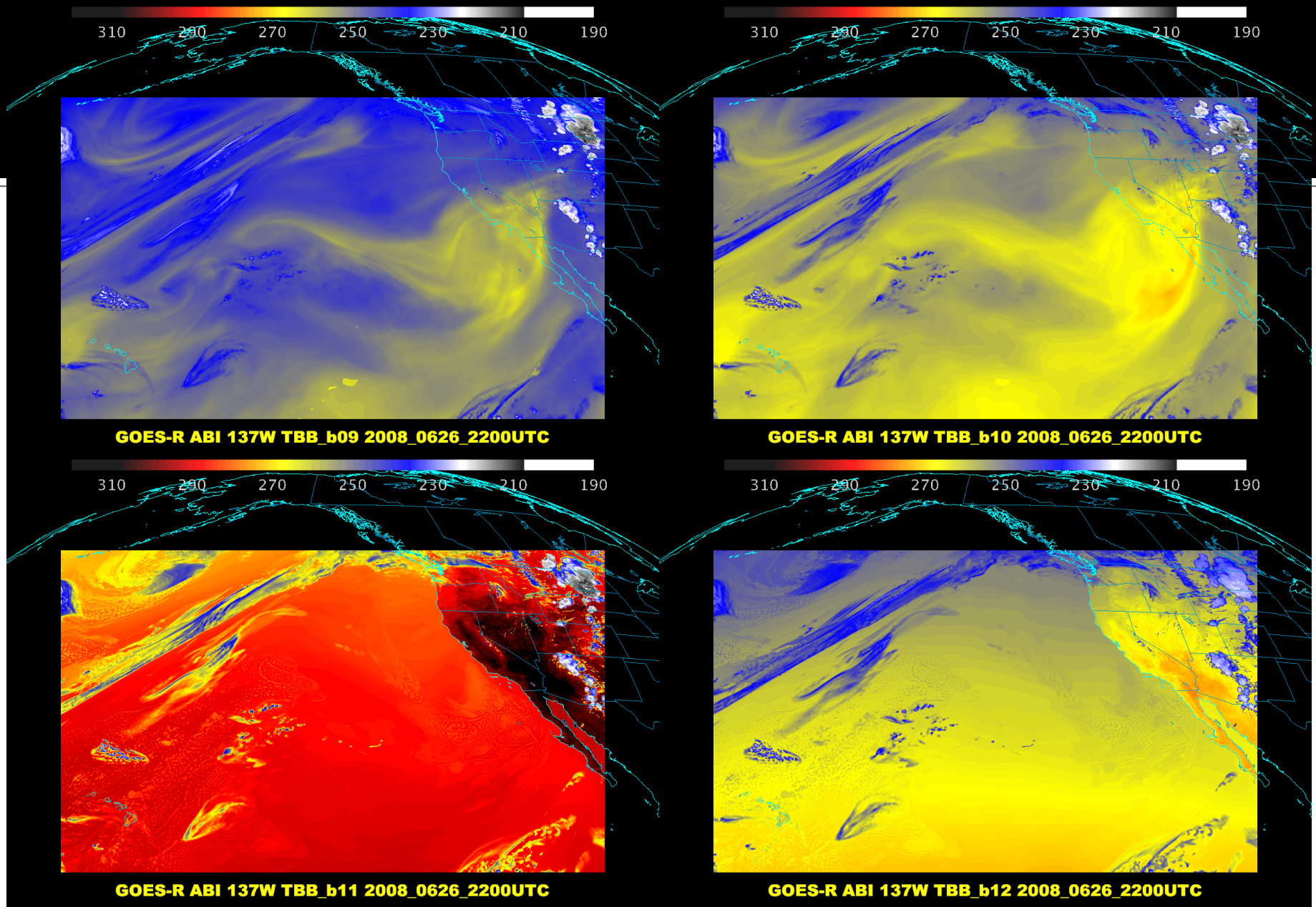
**GOES-R ABI 137W Refl\_b03 2008\_0626\_2200UTC**



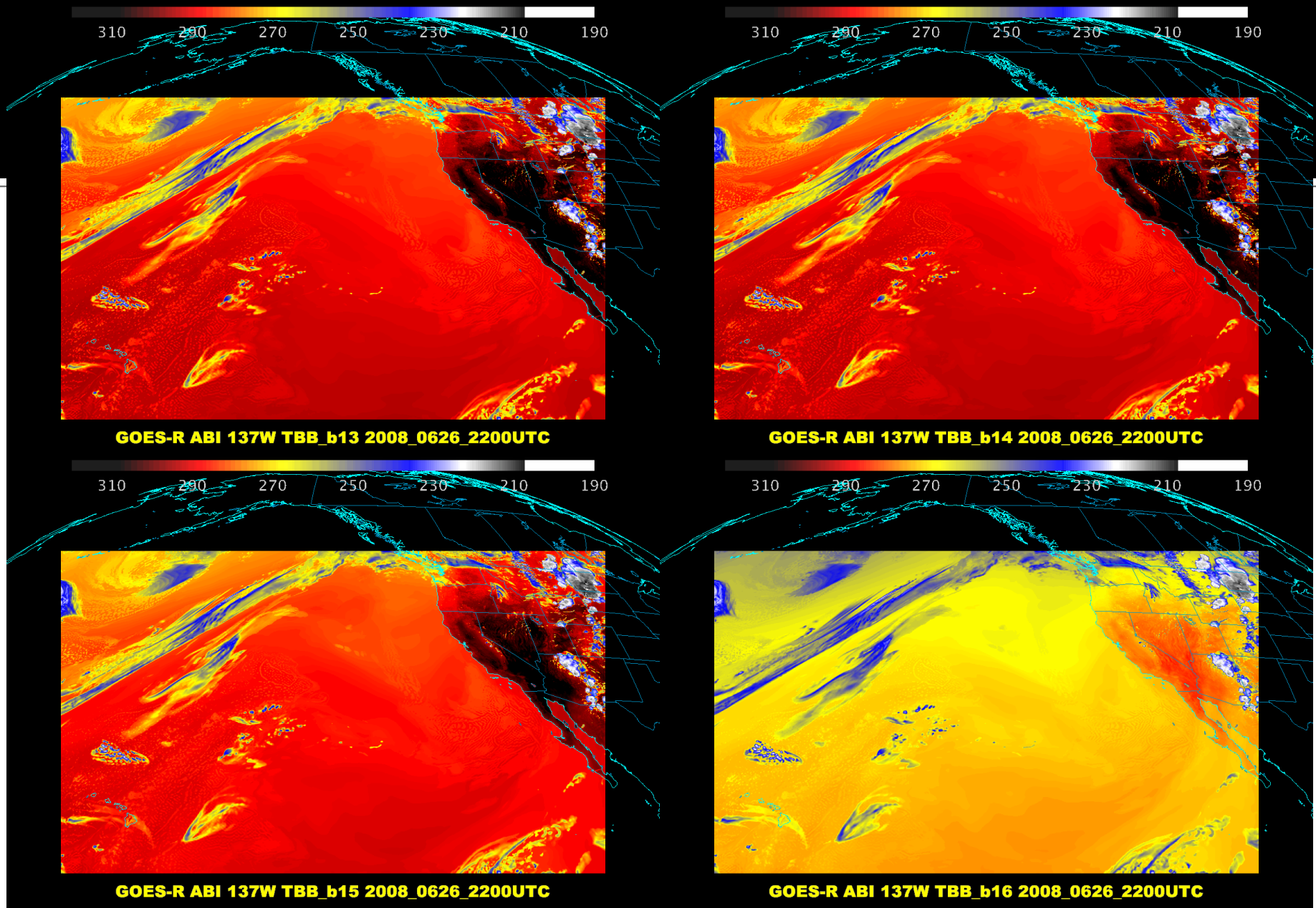
**GOES-R ABI 137W Refl\_b04 2008\_0626\_2200UTC**











Source: Tim Schmit, Mat Gunshor, Kaba Bah

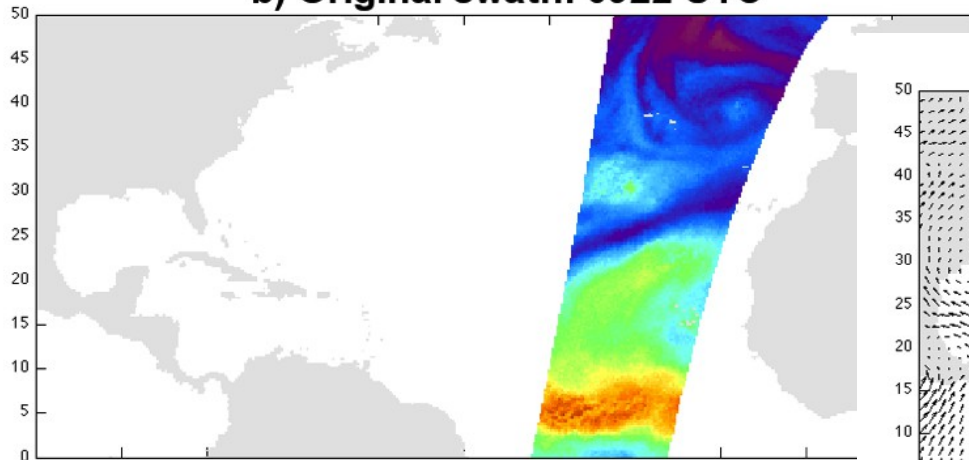
# FY15 Priorities

- Himawari preparation
- **Morphological composites**
- AWIPS II enhancements
  - Improved RGB visualization implementation
  - NUCAPS x-z plane visualization
  - Additional products from CSPP
- Reexamining multi-sensor products
  - Rain rate
  - SST
  - TPW

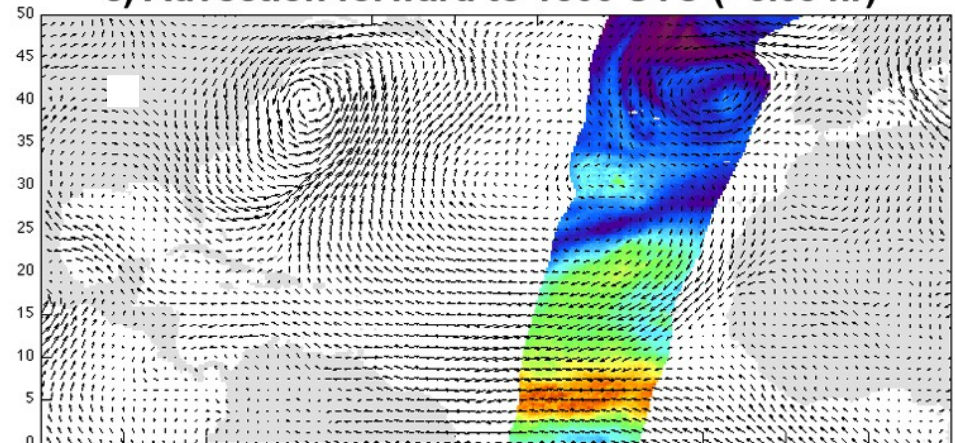
# Morphological Compositing Heritage

- A simpler kind of Morphological Compositing has already been in use at CIMSS in the MIMIC-TPW product
- Uses NWP winds as the advection (nudging) field

**b) Original swath: 0922 UTC**



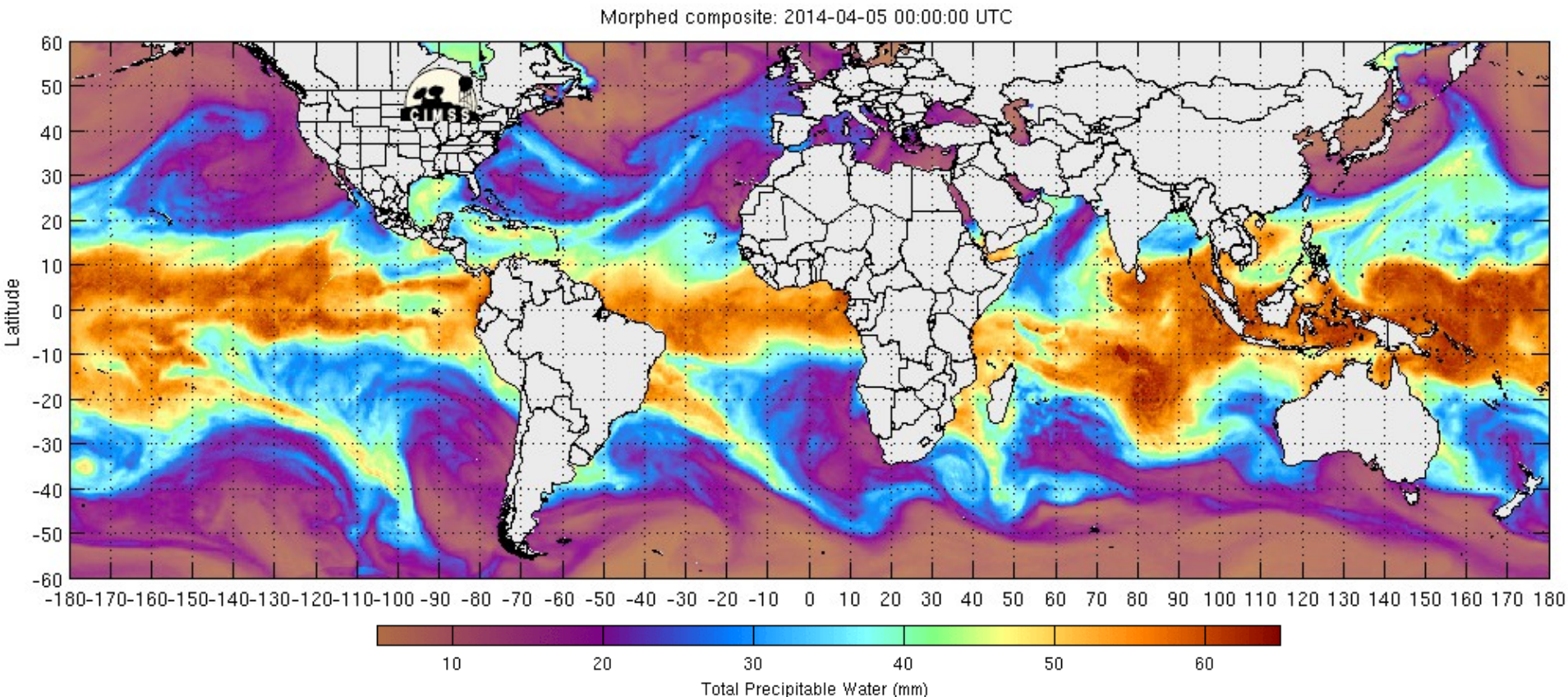
**c) Advection forward to 1500 UTC (+5.63 hr)**



Wimmers, A. and C. Velden, 2011: Seamless Advective Blending of Total Precipitable Water Retrievals from Polar Orbiting Satellites. *J. Appl. Meteor. Clim.*, Vol. 50, 1024-1036.



# Morphological Compositing Heritage



Wimmers, A. and C. Velden, 2011: Seamless Advective Blending of Total Precipitable Water Retrievals from Polar Orbiting Satellites. *J. Appl. Meteor. Clim.*, Vol. 50, 1024-1036.

Source: Anthony Wimmers, Andrew Heidinger



# Morphological Compositing Method

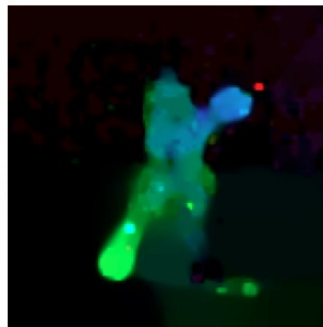
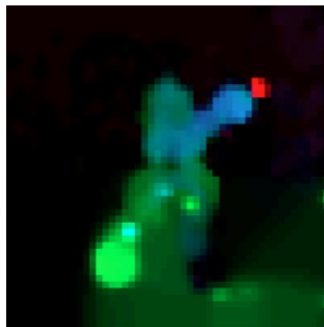
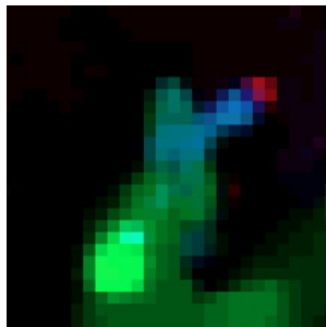
- The Morphological Compositing Algorithm used here extends the MIMIC-TPW method to CLAVR-x/GSIP cloud properties, using a more appropriate “optical flow” algorithm instead of model winds.

# Algorithm

- Rather than a traditional overlay of most-recent imagery into a composite product, the Morphological Compositing Algorithm first determines how the images move into one another (“optical flow”). It then composites together imagery that has been “nudged” to the exact valid time.
- For a CLAVR-x / GSIP product with a one-hour temporal resolution requirement, data advection is only necessary for CLAVR-x imagery. Thus, a CLAVR-x hourly product is computed, then composited with the GSIP product in the final stage.

# Definition of Optical Flow

- “Optical flow” is the calculation of the displacement (a vector field) between two images, normally explaining the motion within the image sequence.
- Here we apply the optical flow technique of Brox et al. [2011].
  - Fast (which is rare)
  - Has components that apply very well to clouds

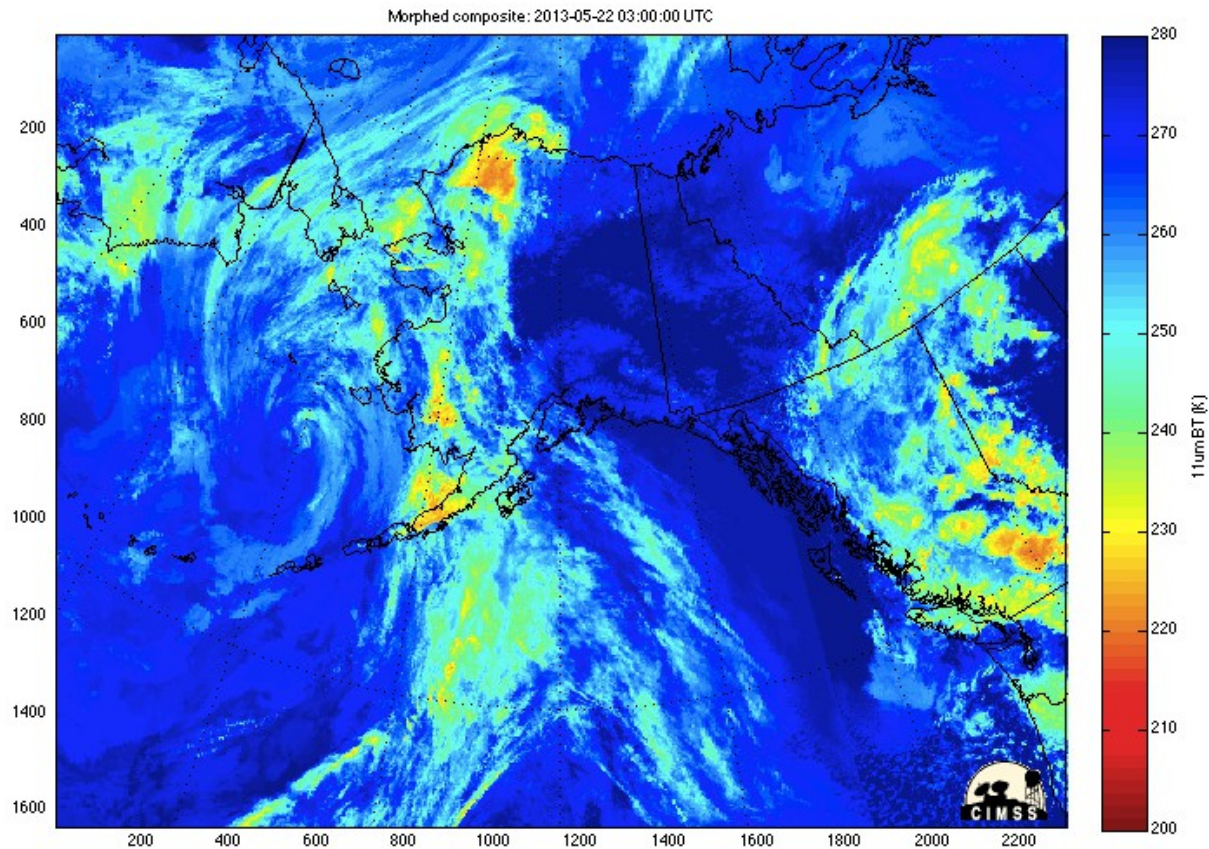


Images 1 and 2  
shown together

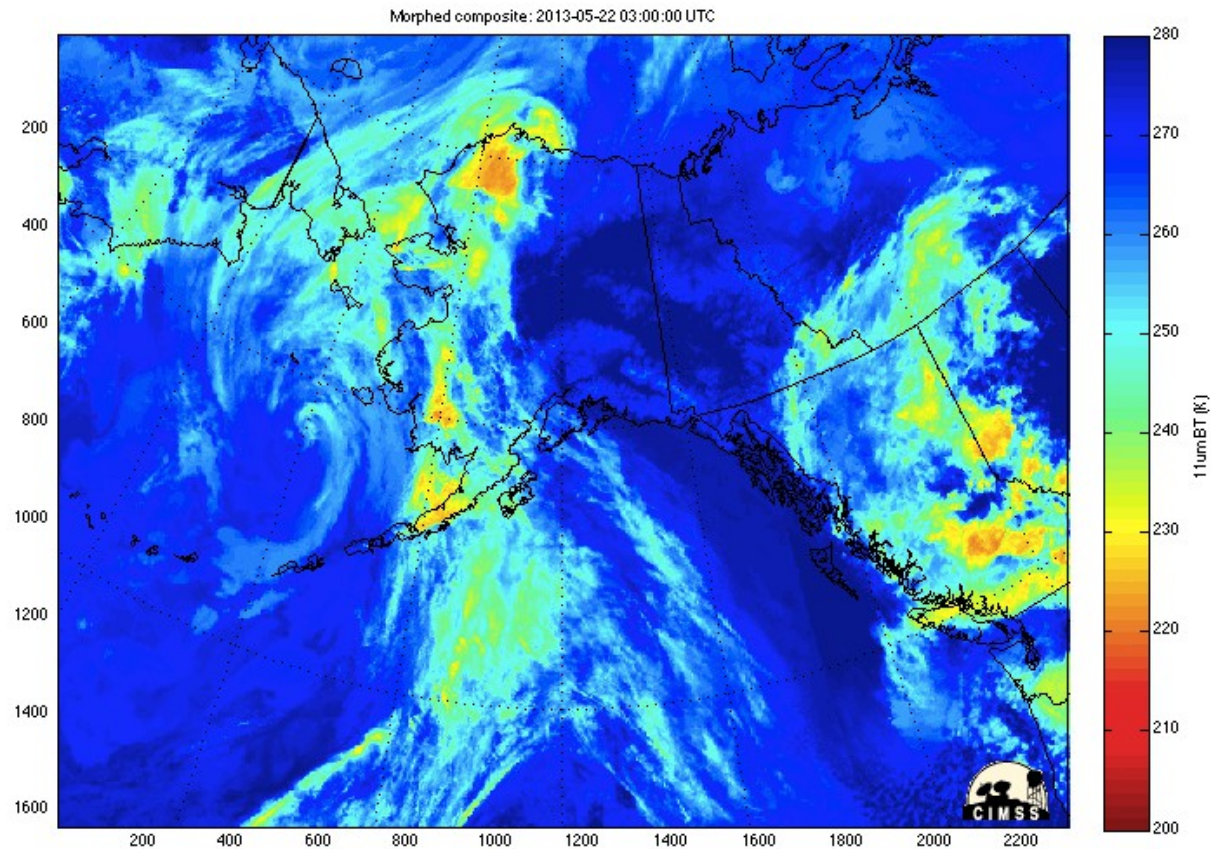
Iterative solution for velocity field between images 1 and 2  
Brox, T. and J. Malik, 2011: Large displacement optical flow: Descriptor matching in  
variational motion estimation, IEEE Transactions on Pattern Analysis and Machine  
Intelligence, 33, 500-513.

Velocity Key  
(e.g. Yellow is  
upward motion)

# Traditional Composite



# Morphed Composite



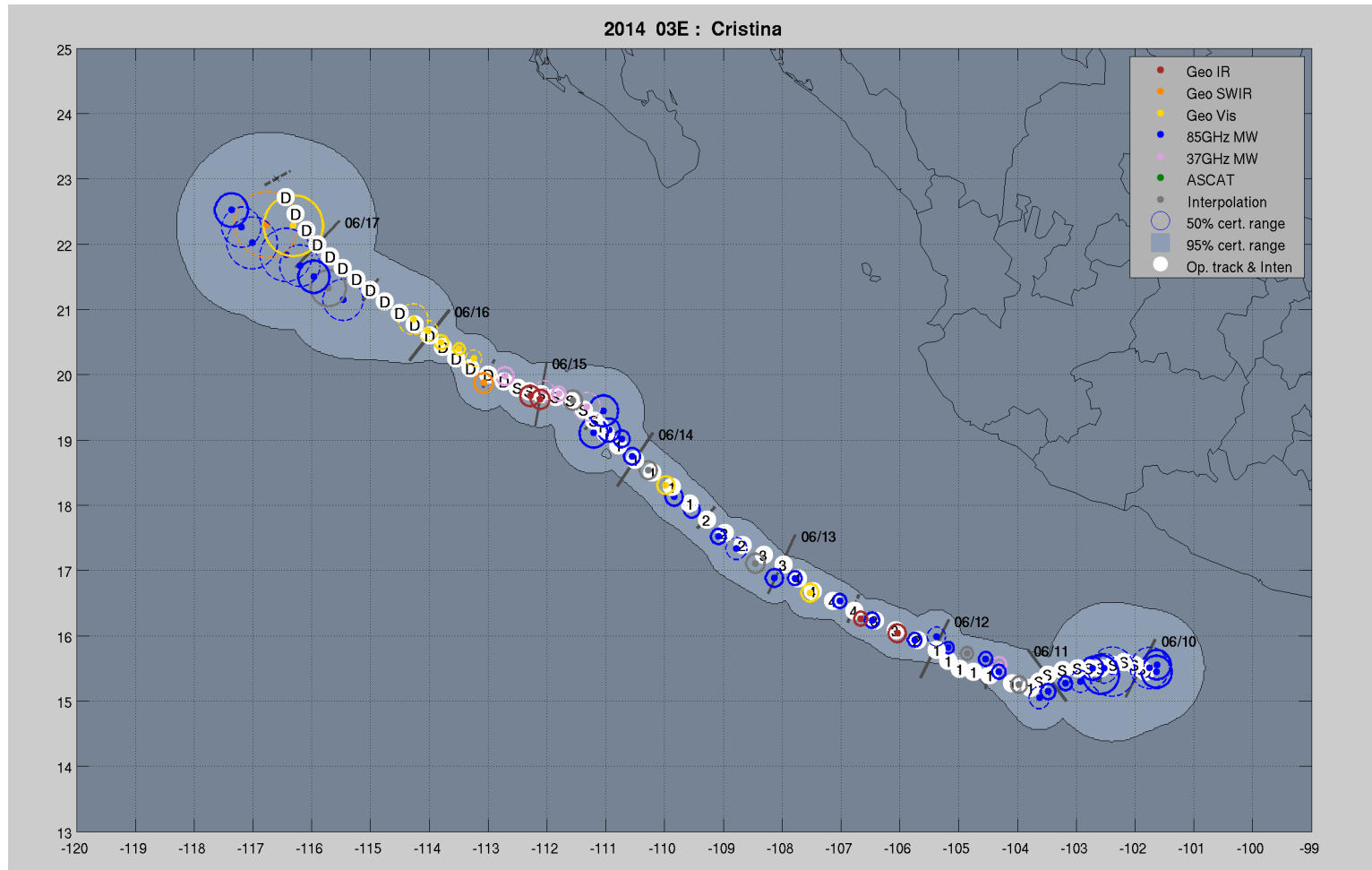
# Advantages of morphological compositing

- Greater accuracy
- Seamless motion
- Greater consistency (in resolution)
- Easier readability



# Other Work at CIMSS

## Automated Tropical Cyclone Tracking



Source: Anthony Wimmers

# Questions? Comments?



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